# A HORIZONTAL LOOP ANTENNA

Bruce Hannaford VK5XI.
57 Haydown Street, Elizabeth Grove, SA 5112

Over a period of years the writer has tried many different HF band antennae often giving each a year or so of use before trying something different. For the past year he has been using a large horizontal loop with quite good results and would like to pass on this very useful design. The main advantages of this antenna being that it will work quite well on all bands from 80 to 10 metres including WARC bands, it need not be very high, will give good all round horizontal directional coverage and the feeder impedance will be low on all bands harmonically related to 80 metres.

To obtain the biggest size loop possible I avoided using poles with guy wires and originally just tied one and a half inch water pipes to the fence at each corner of the back yard. With this type of construction you get the maximum size loop for your size yard but it is not possible to use much tension on the spans of wire and considerable sag will be experienced.

I have improved on this construction since then but still use the 7 metre lengths of water pipe now additionally having about 1.5 metres of round timber driven into the top end thus increasing the height to about 8.5 metres.

The poles are at each corner of the yard which is about 28 metres square thus giving a loop of about 112 metres total length.

An approximate formula for a loop like this is — length in feet = 985 divided by frequency in MHz. Thus for 3.6 MHz a length of 274 feet will be required. *length in metres = 300 divided by frequency in MHz. For 3.6 MHZ a length of 83.33 metres.*

In my case I only have 240 feet, 73 metres, so am 34 feet, 10 metres short. This could be corrected by using loading coils. These must be put at a high current point. Or by making use of a 17 feet, 5 metre; length of open wire feeder.

I have tried inductive loading but now prefer and use open wire line. One advantage of the open feeder is the ease in resonating the loop by pruning the feeder without needing to change the size of the loop itself.

Of course if you have room for a full size loop by all means use it or only use a very short open wire feeder for tuning convenience.

Initial tuning is done by using a one turn coil to couple a dip oscillator to the antenna at its feed point. The feeder or antenna are then pruned to give a dip at say 3.6 MHz.

The feed point impedance in the harmonically related bands will range from about 100 ohms on 80 metres to about 200 ohms on 10 metres and these figures may become lower if the antenna is very close to the ground. Using a 4:1 balun at the feed point and continuing to the transceiver with 50 ohm coaxial cable the SWR will be low enough to be easily dealt with by an ATU.

With all connected as mentioned but not yet using an ATU try the SWR at various points in each band and carefully list the results. From a study of the SWR figures it should be easy to decide if any pruning is needed. If you do any pruning check all bands once again listing results as before. A compromise length will be found that gives reasonably low SWR on all bands without an ATU.

One comment I often get is — "*But a horizontal loop will be directional straight up and down and there will be poor low angle radiation.*" Thinking about quad design this is a valid first impression statement.

This horizontal loop will in fact have a great deal of straight up radiation on 80 metres but this will normally be reflected back at this low frequency and good results will still be obtained. On 40 metres additional lobes are generated and these are still at a rather high angle but likewise will normally be returned to earth at fairly distant points.

As still higher frequencies are used the number of

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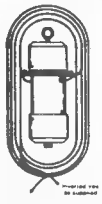

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lobes will increase and the angle of them keeps getting lower to the horizon. By the time we get to 10 metres there will be quite a lot of low angle radiation. All of this is much the same as for a long wire antenna except this long wire is bent around thus dispersing the many lobes in many different horizontal directions.

Of course as the loop is close to ground we will not see the rather sharp free space lobes we would otherwise expect and it will be found, in practice, good all round coverage will be obtained in all bands. The height is not very important so long as the antenna is reasonably clear of absorption problems such as trees etc. I have heard of people using heights as low as 1 metre and can personally vouch that 4 metres is quite workable. I have gone for extra height only to get into a clear space.

This antenna will not equal a rotary beam but it will work efficiently on ALL HF bands. With the no guy wires type of construction it is quite neat in appearance and, in the eyes of most neighbours, much better than a tower with a beam and numerous dipoles to cover the other HF bands.

I now submit a list of my SWR results for your guidance and comparison. I think you will agree that for an ALL HF BANDS antenna the results are quite good and compare favourably with that old favourite, the G5RV. The following readings were obtained from the 50 ohm side of the 4:1 balun, I will just list the frequencies and follow these with the SWR in each case.

*3.55, 2.0; 3.6, 1.1; 3.7, 2.0; 7.0, 1.2; 7.1, 1.1; 7.2, 1.8; 7.3, 2.6; 10.1, 2.9; 10.15, 2.6; 14.0, 1.6; 14.1, 1.9; 14.2, 2.0; 14.3, 3.0; 18.1, 4.5; 21.0, 1.9; 21.1, 2.3; 21.2, 2.7; 21.3, 3.0; 21.4, 3.5; 24.9, 3.5; 28.0, 2.5; 28.25, 2.9; 28.5, 4.00 & 28.75, 5.0.*

Well the figures tell their own story and of course you can prune to suit the bands or portions of bands you most often use. With an ATU added the above SWR figures could in all cases be easily brought down to 1:1 and even the frequencies with the worst SWR gave very effective radiation and reception. As the length of coaxial cable used was quite short the losses at even 5:1 SWR were negligible. Without the balun the SWR was in almost all cases much higher and in some cases as high as 9:1.

When part of a loop is made up of open wire feeder or loading coils the harmonics of the lowest possible full wave loop frequency will not be exact multiples of this fundamental frequency and even if a full sized loop is used they will be only approximately multiples of the fundamental frequency. I will give the dip frequencies that I got in my case giving first the harmonic number then the frequency. These were taken at the end of the open wire feeder without the balun in place. It will be noticed that unlike dipoles both odd and even number harmonics are useful with loops and this is very handy indeed. 1 3.75 — 2 7.32 — 3 10.85 — 4 14.11 — 5 17.5 — 6 20.85 — 7 24.4 & 8 28.1. I note that pruning to get the dips close to the amateur band centre frequencies is not the best procedure, it is best to prune for a low SWR.

An alternative design for such loops is to bring the open wire feeder into the shack and use a balanced ATU followed by coaxial cable to the transceiver. With this design it is not really necessary to use any special length of wire in the loop just make it as large as possible and the ATU will take care of resonating it at any frequency.

It is possible to use TV ribbon instead of the open wire feeder but I don't recommend this if high power is to be used. Virtually any spacing open wire feeder can be used as this is not critical in any way.

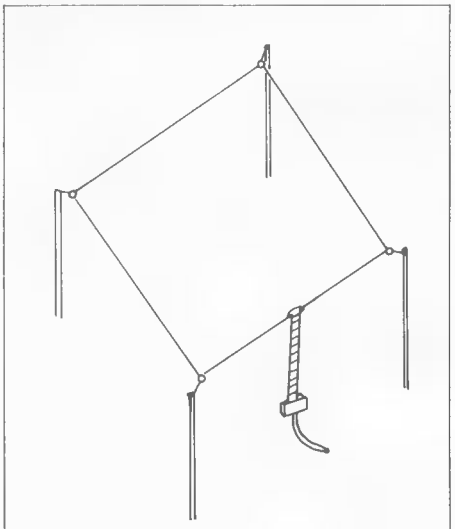

**Figure 1**

**HORIZONTAL LOOP ANTENNA**

**A square loop is shown but any reasonably open shape will be satisfactory. The feedline is shown in the centre of one side however other positions such as a corner will be almost as good. The coaxial cable can be any length but shorter lengths are preferred due to fairly high SWR on some bands.**

*Technical Editors Note.*

*This antenna is an interesting approach to the problem of getting out from a suburban area with limited space. The aim is to talk to other amateurs rather than lead the DX dogpile.*

*Caution should be exercised in the choice and rating of the balun used. Most baluns have power ratings which are only valid for low SWR. When a balun is used at higher SWR values it should be derated. The higher currents and voltages may result in undesirable effects. These are due to possible saturation effects in ferrites, heating of wires, and insulation voltage levels.*

*As a result of this at high SWR values a balun may have to be derated.*

*This article has been converted to metric measurements.*

*Technical Editor*

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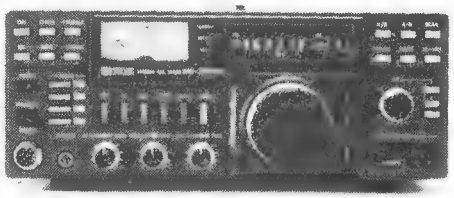

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